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COLOR PICTURE TUBE

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ABSTRACT

PURPOSE: To provide a color picture tube which hardly causes deterioration in color purity by suppressing landing displacement caused by doming of a mas main body.

CONSTITUTION: A color picture tube has a shadow mask comprising a practically square mask main body 3 in which a skirt part 39 is formed around a main face part 37 facing a fluorescent material screen through a no-hole part 38 and a practically square mask frame fixed to the skirt part 39. Slit-like through holes 43 which are long in the tube axis direction are formed in the skirt part 39 of the mask main body 30.

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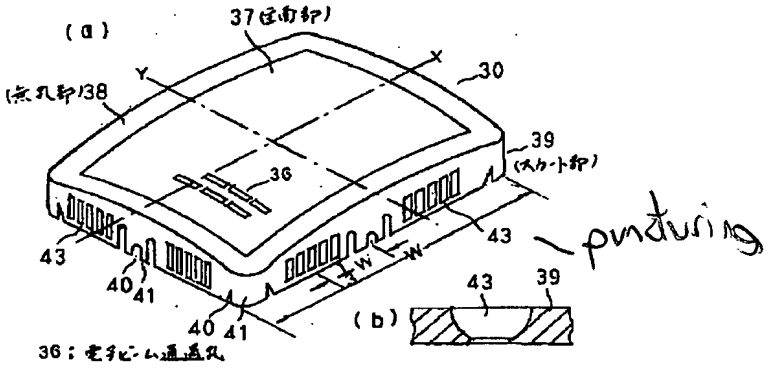
(54)【発明の名称】　カラー受像管

(57)【要約】

【目的】　マスク本体のドーミングによるランディングずれを抑制して色純度の劣化をおこしにくいカラー受像管を構成することを目的とする。

【構成】蛍光体スクリーンと対向する主面部37のまわりに無孔部38を介してスカート部39が形成された実質的に矩形状のマスク本体30と、そのスカート部に取付けられた実質的に矩形状のマスクフレームとからなるシャドウマスクを有するカラー受像管において、マスク本体のスカート部に管軸方向に長いスリット状貫通孔43を形成した。



【特許請求の範囲】

【請求項１】　蛍光体スクリーンと対向する主面部に多数の電子ビーム通過孔が形成され、この主面部のまわりに無孔部を介してスカート部が形成された実質的に矩形状のマスク本体と、上記スカート部に取付けられた実質的に矩形状のマスクフレームとからなるシャドウマスクを有するカラー受像管において、

上記マスク本体は上記スカート部に管軸方向に長いスリット状貫通孔が形成されていることを特徴とするカラー受像管。

【請求項２】　蛍光体スクリーンと対向する主面部に多数の電子ビーム通過孔が形成され、この主面部のまわりに無孔部を介してスカート部が形成された実質的に矩形状のマスク本体と、上記スカート部に取付けられた実質的に矩形状のマスクフレームとからなるシャドウマスクを有し、上記電子ビーム通過孔が上記マスク本体の短軸方向に列状に延びる電子ビーム通過孔列を構成し、この電子ビーム通過孔列が上記マスク本体の長軸方向に複数列配列されてなるカラー受像管において、

上記マスク本体はこのマスク本体の短軸からこのマスク本体の長径の約１／３の位置を中心として上記長径の約１／４の幅の範囲に位置する長辺側の無孔部に上記短軸方向に長い貫通孔または底部板厚がマスク本体の板厚よりも薄い凹孔が形成されていることを特徴とするカラー受像管。

【請求項３】　蛍光体スクリーンと対向する主面部に多数の電子ビーム通過孔が形成され、この主面部のまわりに無孔部を介してスカート部が形成された実質的に矩形状のマスク本体と、上記スカート部に取付けられた実質的に矩形状のマスクフレームとからなるシャドウマスクを有し、上記電子ビーム通過孔が上記マスク本体の短軸方向に列状に延びる電子ビーム通過孔列を構成し、この電子ビーム通過孔列が上記マスク本体の長軸方向に複数列配列されてなるカラー受像管において、

上記マスク本体はこのマスク本体の短軸からこのマスク本体の長径の約１／３の位置を中心として上記長径の約１／４の幅の範囲に位置する長辺側の無孔部に上記短軸方向に長い貫通孔または底部板厚がマスク本体の板厚よりも薄い凹孔が形成され、かつ上記マスク本体の長径の約１／３の位置を中心として上記長径の約１／４の幅の範囲に位置する長辺側のスカート部に管軸方向に長い貫通孔が形成されていることを特徴とするカラー受像管。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】この発明は、カラー受像管に係り、特にシャドウマスクの熱膨張による蛍光体層に対する電子ビームのランディングずれを抑制したカラー受像管に関する。

【０００２】

【従来の技術】一般にカラー受像管は、図１１に示すように、有効部１が曲面からなる実質的に矩形状のパネル２とこのパネル２に接合された漏斗状のファンネル３とからなる外囲器を有する。そのパネル２の有効部１の内面に、青、緑、赤に発光する３色蛍光体層からなる蛍光体スクリーン４が形成されている。さらにこの蛍光体スクリーン４と所定間隔離れて、その内側に実質的に矩形状のマスク本体５とこのマスク本体５の周辺部に取付けられたマスクフレーム６とからなる実質的に矩形状のシャドウマスク７が配置されている。そのマスク本体５は、図１２に示すように、多数の電子ビーム通過孔８が所定の配列で形成され、上記蛍光体スクリーンと対向する曲面からなる主面部９と、この主面部９を取巻く無孔部１０と、この無孔部１０を介して主面部９のまわりに設けられたスカート部１１とからなる。またマスクフレーム６は、断面Ｌ字形に形成され、上記スカート部１１に溶接により取付けられている。一方、ファンネル３のネック１３内に３電子ビーム１４を放出する電子銃１５が配設されている。そして、この電子銃１５から放出される３電子ビーム１４をファンネル３の外側に装着された偏向装置１６の発生する磁界により偏向し、上記マスク本体５の電子ビーム通過孔８を介して蛍光体スクリーン４を水平、垂直走査することにより、カラー画像を表示する構造に形成されている。

【０００３】このようなカラー受像管のうち、特に同一水平面上を通る一列配置の３電子ビーム１４を放出するインライン形カラー受像管においては、蛍光体スクリーン４の３色蛍光体層は、管軸（Ｚ軸）と直交する垂直方向（短軸方向）に細長いストライプ状に形成され、これに対応して、マスク本体５は、垂直方向に長い複数の電子ビーム通過孔８が垂直方向に延びる電子ビーム通過孔列を構成し、この電子ビーム通過孔列が水平方向（長軸方向、Ｘ軸方向）に複数列並列配置されたものとなっている。

【０００４】ところで、上記シャドウマスク７は、各電子ビーム通過孔８を異なる角度で通過する３電子ビーム１４がそれぞれ所定の蛍光体層をランディングするように選別するためのものであり、電子ビーム１４の走査によって蛍光体スクリーン４上に描かれる画像の色純度を良好にするためには、上記各電子ビーム通過孔８を異なる角度で通過する３電子ビーム１４がそれぞれ所定の蛍光体層に正しくランディングするようにすることが必要である。そのためには、蛍光体スクリーン４に対してマスク本体５が所定の整合関係に正しく配置され、かつカラー受像管の動作中、その整合関係が保持されることが必要である。とりわけ、パネル２の有効部１内面とマスク本体５の主面部９との間隔（ｑ値）が所定の許容範囲に保たれることが必要である。

【０００５】しかしながら上記カラー受像管は、動作原理上、マスク本体５の各電子ビーム通過孔８を通って蛍光体スクリーン４に達する電子ビームは、電子銃１５か

ら放出される全電子ビーム量の１／３以下であり、他の電子ビームは、そのほとんどがマスク本体５に衝突して熱エネルギに変換され、マスク本体５を８０℃程度に加熱する。その結果、特にマスク本体５が熱膨張係数の大きい（１．２×１０$^{-5}$／℃）板厚０．１～０．３㎜の冷間圧延鋼板からなり、マスクフレーム６がそれよりも機械的強度の大きい板厚１㎜程度の冷間圧延鋼板からなるシャドウマスク７では、熱膨張によりマスク本体５の主面部９が蛍光体スクリーン４に膨出するいわゆるドーミングをおこす。その結果、パネル２の有効部１内面とマスク本体５の主面部９との間隔が許容値を越えると、マスク本体５の電子ビーム通過孔８の位置変化により、３色蛍光体層に対する電子ビーム１４のランディングがずれ、色純度の劣化がおこる。

【０００６】上記３色蛍光体層に対する３電子ビームのランディングずれは、カラー受像管の動作開始初期、マスク本体５全体が熱膨張するために生ずるランディングずれと、局部的に高輝度画像を表示した場合に生ずる局部的なドーミングにより生ずるランディングずれとがある。そのランディングずれの大きさは、画面上に描かれる画像パターンの輝度、その継続時間などによって異なる。たとえば画面全体に長時間高輝度画像を表示した場合には、画面全域の比較的広い範囲で色純度の劣化がおこる。また局部的に高輝度の画像を表示した場合には、図１３に破線１８で示したように、局部的なドーミングがおこり、短時間にランディングがずれ、かつそのランディングずれが大きく、局部的な色純度の劣化がおこる。

【０００７】上記局部的なドーミングによるランディングずれについては、図１４に示すように、蛍光体スクリーン４上に大電流ビームにより垂直方向を長径とする矩形状の高輝度パターン２０を描き、その形状、位置を変えてランディングのずれ量を測定した結果、高輝度パターン２０を画面中心から水平方向に画面水平方向径（長径）Wの１／３程度離れた位置に描いた場合に最も大きくなり、図１５に示すように、水平方向中間部の楕円領域２１で最も大きくなるという結果が得られている。

【０００８】このように水平方向中間部でランディングずれが大きくなる理由は、つぎのように説明することができる。すなわち、図１４に示した高輝度パターン２０を画面中央部に描いた場合は、この高輝度パターン２０に対応してマスク本体の主面部の中央部が加熱され、熱膨張するが、主面部の中央部の電子ビーム通過孔を通過する電子ビームは、偏向角が小さいため、ランディングずれは小さい。しかし画面中央部から水平方向に動かすにつれて偏向角が大きくなり、マスク本体の熱膨張によるランディングずれが画面上に現れる度合いが大きくなる。しかし画面水平方向両端部に対応するマスク本体の主面部の水平方向両端部は、機械的強度の大きいマスクフレームに取付けられているため、マスク本体の熱膨張が抑制され、画面水平方向両端部でのランディングずれは小さくなる。その結果、マスク本体の熱膨張によるランディングずれは、画面中央部から水平方向に画面水平方向径Wの１／３程度離れた中間部に高輝度パターン２０を描いた場合、つまり、図１５に示した水平方向中間部の楕円領域２１で最も大きくなる。この楕円領域２１は、マスク本体の主面部の中央部から水平方向に、その主面部の水平方向径の約１／３離れた位置Ｐ１ を中心とし、その水平方向径の約１／４を幅とする領域に対応する。

【０００９】従来より、上記マスク本体のドーミングによるランディングずれを抑制するいくつかの手段が開発されている。特に動作開始初期のランディングずれを抑制するものとして、下記（イ）および（ロ）の手段がある。

（イ）　米国特許第２，８２６，５３８号明細書に記されている手段で、マスク本体の熱放射を促進すべく、マスク本体の主面部の表面に黒鉛を主成分とする黒鉛層を設け、この黒鉛層を放熱器としてマスク本体の温度を低下させるようにしたもの◎

（ロ）　特願昭５８－１４８８４３号明細書に記されている手段で、マスク本体の主面部の電子銃側の面に、鉛ホウ酸塩ガラスなどのガラス層を設けたもの。◎

このように鉛ホウ酸塩ガラス層を設けると、その熱伝導率がマスク本体のそれよりも小さいため、マスク本体に伝達される熱量が少なくなり、マスク本体の温度上昇を抑制することができる。また鉛ホウ酸塩ガラス層を設けることにより、マスク本体の機械的強度が向上する。さらにマスク本体に鉛ホウ酸塩ガラスが溶着し結晶化すると、ガラス層に圧縮応力、マスク本体に引張応力が作用し、マスク本体の張り強度が向上する。

【００１０】なお、これらの手段により、マスク本体の局部的なドーミングを抑制するようにすることも可能である。

【００１１】さらにマスク本体の局部的なドーミングを抑制する手段として、

（ハ）　マスク本体の主面部の曲率を大きくする方法がある。この方法については、特に短軸方向の曲率を大きくすることが有効であることが知られている。

【００１２】

【発明が解決しようとする課題】上記のようにカラー受像管のシャドウマスクは、電子銃から放出される電子ビームの衝突によりマスク本体が加熱、熱膨張して、主面部が蛍光体スクリーン方向に膨出するドーミングをおこし、３色蛍光体層に対する電子ビームのランディングがずれ、色純度の劣化がおこるという問題がある。

【００１３】従来より、このマスク本体のドーミングによるランディングずれを抑制するいくつかの手段が開発されている。

【００１４】その一つとして（イ）に示したように、マ

スク本体の主面部の表面に黒鉛層を設ける方法がある。しかしこの方法は、カラー受像管の製造工程で繰返される熱処理により黒鉛層の密着が劣化し、カラー受像管に加わる振動により剥離しやすく、その剥離した微小片がマスク本体に付着して電子ビーム通過孔を詰まらせ、蛍光体スクリーン上に表示される画像の品位を低下させる。また電子銃あるいはその付近に付着してスパーク放電を誘発させ、耐電圧特性を低下させるなどの問題が生じやすい。

【００１５】また（ロ）に示したように、マスク本体の主面部の電子銃側の面に、鉛ホウ酸塩ガラスなどのガラス層を設ける方法がある。しかしこの方法は、鉛ホウ酸塩ガラス中に含まれる酸化鉛（ＰｂＯ）の量が７０～８５％と多いため、シャドウマスクにより遮蔽される電子ビームの管内での乱反射が増し、通常白浮きといわれるコントラストの低下が生ずる。また板厚が０．１～０．３㎜の冷間圧延鋼板からなるマスク本体に鉛ホウ酸塩ガラスの層を設けると、その溶着、結晶化により、ガラス層に圧縮応力、マスク本体に引張応力が作用するため、これら応力のバランスが崩れた場合にマスク本体を変形させやすい。すなわち、通常ガラス層の厚さは、１０～２０μｍ が好ましいとされているが、たとえば板厚０．２㎜以下の冷間圧延鋼板からなるマスク本体に、製造上のばらつきにより２０μｍ を越える厚さのガラス層が形成されると、マスク本体が変形するという問題がある。

【００１６】また（ハ）に示したように、マスク本体の主面部の曲率を大きくする方法がある。特にこの方法では、短軸方向の曲率を大きくすることが有効であることが知られている。しかしこの方法については、最近のパネルの有効部の曲率が小さい平坦化したカラー受像管では、その有効部内面の曲率も小さく、それに対応してマスク本体の主面部の曲率も、マスク本体の中心から周辺に至るまで小さくなる。そのため、平坦化したカラー受像管では、図１５に示した楕円領域２１の垂直方向の端部Ｐ2 が長辺側周辺まで広がる傾向がある。また平坦化したカラー受像管において、マスク本体の主面部の曲率を大きくするためには、パネルの有効部内面の曲率も大きくする必要がある。そのため、特に画面のアスペクト比が４：３の横長のカラー受像管では、パネルの中央部と周辺部との肉厚の差がいちじるしく大きくなり、特性上好ましくなくなる。さらに従来の通常のカラー受像管でも、マスク本体の電子ビーム通過孔の形成されている主面部と電子ビーム通過孔の形成されていない無孔部とでは、熱容量が異なるため、主面部と無孔部との境界部で熱伝導差が生ずる。そのため、マスク本体の温度分布は、図７に曲線２３で示したように、無孔部の温度に対して主面部の温度が極端に高くなり、主面部のドーミングが大きくなりやすいなどの問題がある。

【００１７】この発明は、上記問題点に鑑みてなされたものであり、第１の目的は、マスク本体の主面部に黒鉛層やガラス層を設けることなく、マスク本体のドーミングによる蛍光体層に対する電子ビームのランディングずれを抑制して、色純度の劣化をおこしにくいカラー受像管を構成することにある。第２の目的は、マスク本体の主面部の曲率を大きくすることなく、マスク本体のドーミングによる蛍光体層に対する電子ビームのランディングずれを抑制して、色純度の劣化をおこしにくいカラー受像管を構成することにある。

【００１８】

【課題を解決するための手段】蛍光体スクリーンと対向する主面部に多数の電子ビーム通過孔が形成され、この主面部のまわりに無孔部を介してスカート部が形成された実質的に矩形状のマスク本体と、そのスカート部に取付けられた実質的に矩形状のマスクフレームとからなるシャドウマスクを有するカラー受像管において、マスク本体のスカート部に管軸方向に長いスリット状貫通孔を形成した。

【００１９】また、蛍光体スクリーンと対向する主面部に多数の電子ビーム通過孔が形成され、この主面部のまわりに無孔部を介してスカート部が形成された実質的に矩形状のマスク本体と、そのスカート部に取付けられた実質的に矩形状のマスクフレームとからなるシャドウマスクを有し、電子ビーム通過孔がマスク本体の短軸方向に列状に延びる電子ビーム通過孔列を構成し、この電子ビーム通過孔列がマスク本体の長軸方向に複数列配列されてなるカラー受像管において、マスク本体の短軸からこのマスク本体の長径の約１／３の位置を中心としてその長径の約１／４の幅の範囲に位置する長辺側の無孔部に短軸方向に長い貫通孔または底部板厚がマスク本体の板厚よりも薄い凹孔を形成した。

【００２０】さらにそのマスク本体の短軸からこのマスク本体の長径の約１／３の位置を中心としてその長径の約１／４の幅の範囲に位置する長辺側の無孔部に短軸方向に長い貫通孔または底部板厚がマスク本体の板厚よりも薄い凹孔を形成し、かつマスク本体の長径の約１／３の位置を中心としてその長径の約１／４の幅の範囲に位置する長辺側のスカート部に管軸方向に長い貫通孔を形成した。

【００２１】

【作用】上記のように、マスク本体のスカート部に管軸方向に長いスリット状貫通孔を形成すると、スカート部の剛性を低くすることができる。したがってそれにより、電子ビームの衝突によりマスク本体が加熱され熱膨張しても、その熱膨張をスカート部の変形により吸収して、主面部が蛍光体スクリーン方向に膨出するマスク本体のドーミングを低減することができる。その結果、蛍光体層に対する電子ビームのランディングずれによる色純度の劣化を防止することができる。

【００２２】また、マスク本体の短軸からこのマスク本体の長径の約１／３の位置を中心としてその長径の約１

／４の幅の範囲に位置する長辺側の無孔部に短軸方向に長い貫通孔または底部板厚がマスク本体の板厚よりも薄い凹孔を形成し、より好ましくは、マスク本体の短軸からこのマスク本体の長径の約１／３の位置を中心としてその長径の約１／４の幅の範囲に位置する長辺側の無孔部に短軸方向に長い貫通孔または底部板厚がマスク本体の板厚よりも薄い凹孔を形成し、かつマスク本体の長径の約１／３の位置を中心としてその長径の約１／４の幅の範囲に位置する長辺側のスカート部に管軸方向に長い貫通孔を形成すると、従来電子ビーム通過孔の形成されている主面部と電子ビーム通過孔の形成されていない無孔部とで熱容量が異なるために生じた主面部と無孔部との境界部での温度差を低減し、主面部の温度上昇を抑えることができ、主面部のドーミングを低減することができる。さらに電子ビーム通過孔列の配列間隔、主面部の曲率を適正化することにより、従来局部的なドーミングが大きく現れた楕円領域（図１６参照）のドーミングを抑制することができる。その結果、蛍光体層に対する電子ビームのランディングずれによる色純度の劣化を防止することができる。

【００２３】

【実施例】以下、図面を参照してこの発明を実施例に基づいて説明する。

【００２４】実施例１．図１に実施例１のカラー受像管を示す。このカラー受像管は、有効部１が曲面からなる実質的に矩形状のパネル２とこのパネル２に接合された漏斗状のファンネル３とからなる外囲器を有する。そのパネル２の有効部１の内面に、青、緑、赤に発光する３色蛍光体層からなる蛍光体スクリーン４が形成されている。さらにこの蛍光体スクリーン４と所定間隔離れて、その内側に後述するマスク本体３０とこのマスク本体３０の周辺部に取付けられたマスクフレーム３１とからなる実質的に矩形状のシャドウマスク３２が配置され、パネル２に設けられた複数個のスタツドピン３３とマスクフレーム３１に取付けられてその各スタツドピン３３に係止する複数個の弾性支持体３４とによりパネル２の内側に支持されている。一方、ファンネル３のネック１３内に３電子ビーム１４を放出する電子銃１５が配設されている。そして、この電子銃１５から放出される３電子ビーム１４をファンネル３の外側に装着された偏向装置１６の発生する磁界により偏向し、上記マスク本体５の電子ビーム通過孔８を介して蛍光体スクリーン４を水平、垂直走査することにより、カラー画像を表示する構造に形成されている。

【００２５】上記シャドウマスク３２のマスク本体３０は、板厚０．１～０．３㎜の冷間圧延鋼板からなる実質的に矩形状に形成され、図２（ａ）に示すように、上記蛍光体スクリーンと対向する曲面に、マスク本体３０の短軸方向（Ｙ軸方向）に長い複数個のスリット状電子ビーム通過孔３６がその短軸方向に列状に延びる電子ビーム通過孔列を構成し、この電子ビーム通過孔列がマスク本体３０の長軸方向（Ｘ軸方向）に複数列形成された主面部３７と、この主面部３７を取巻く無孔部３８と、この無孔部３８を介して主面部３７のまわりに設けられたスカート部３９とからなる。その長辺側および短辺側スカート部３９の中央部およびコーナー部スカート部３９の解放端縁部には、それぞれ複数個の切欠き４０が設けられている。一方、マスクフレーム３１は、板厚１㎜程度の冷間圧延鋼板からなる断面Ｌ字形の実質的に矩形状に形成されている。そしてこれらマスク本体３０とマスクフレーム３１とは、マスク本体３０のスカート部３９をマスクフレーム３１の内側にし、上記切欠き４０により囲まれた舌片部４１で溶接されている。

【００２６】さらにこの実施例１のマスク本体３０には、長辺側および短辺側スカート部３９の中央部とコーナー部との中間部に、それぞれスカート部３９の幅方向（管軸方向と一致）に長い図２（ｂ）に示す複数個のスリット状開孔４３が並列形成されている。これら開孔４３のうち、特に長辺側の開孔４３については、好ましくは、マスク本体３０の短軸からマスク本体３０の長径ｗの約１／３の位置を中心として、その長径ｗの約１／４の幅の範囲に設けられる。

【００２７】このようなマスク本体３０は、従来のマスク本体と同様に、フォトエッチング法により平板状のフラットマスクを形成したのち、このフラットマスクをプレス成形することにより製造されるが、そのフラットマスクを形成するとき、両面からエッチングして、図３に示すように、蛍光体スクリーンと対向する主面部となる部分３７ａ に電子ビーム通過孔３６を所定の配列で形成すると同時に、スカート部となる部分３９ａ に切欠き４０および開孔４３を形成することにより得られる。

【００２８】ところで、上記のように、マスク本体３０のスカート部３９にスリット状開孔４３を設けると、従来のスカート部にスリット状開孔を設けないマスク本体にくらべてスカート部３９の剛性を低くすることができる。その結果、図４（ａ）に示すように、電子ビームの衝突によりマスク本体３０が加熱されて熱膨張するとき、その熱膨張を破線で示したスカート部３９の変形により吸収し、主面部３７が蛍光体スクリーン方向に膨出するドーミングを低減することがでる。

【００２９】すなわち、従来のシャドウマスクについては、図４（ｂ）に示したように、マスク本体５の周辺部が比較的剛性の高いスカート部１１を介してマスクフレーム６に取付けられているために、電子ビームの衝突によりマスク本体５が加熱されると、熱膨張により、主面部９が破線で示したように蛍光体スクリーン方向に大きく膨出するドーミングがおこり、蛍光体層に対する電子ビームのランデイングがずれ、色純度の劣化が生じたが、この例のマスク本体３０のようにスカート部３９にスリット状開孔４３を設けると、その剛性の低下によ

り、図４（ａ）に示したようにスカート部３９が変形し、主面部３７が蛍光体スクリーン４方向に膨出するドーミングを低減することができる。したがって蛍光体層に対する電子ビームのランデイングずれが小さくなり、色純度の劣化を防止することができる。しかも上記のようにマスク本体３０のスカート部３９にスリット状開孔４３を設けても、スカート部３９の解放端縁は、従来のマスク本体のスカート部と同様につながっており、マスクフレームの内側へのスカート部の挿入を困難にすることがなく、従来のシャドウマスクの組立てと同様に組立てることができる。

【００３０】なお、上記実施例では、マスク本体のスカート部のスリット状開孔を、フラットマスクを形成するとき、フォトエッチング法により主面部の電子ビーム通過孔と同時に形成したが、図５（ａ）に示すように、フォトエッチング法によりフラットマスクを形成するとき、主面部の電子ビーム通過孔３６と同時にスカート部のスリット状開孔を形成せず、フラットマスク形成後、打抜き加工により、同（ｂ）に示すように、上記フラットマスクのスカート部となる部分にスリット状開孔４３を形成してもよい。

【００３１】実施例２．カラー受像管の全体の構成は、実施例１のカラー受像管とほぼ同じであるので、その説明を省略し、その要部構成であるマスク本体について説明する。

【００３２】この実施例２のマスク本体は、板厚０．１～０．３㎜の冷間圧延鋼板からなる実質的に矩形状に形成され、図６（ａ）に示すように、蛍光体スクリーンと対向する曲面に複数個のスリット状電子ビーム通過孔３６がマスク本体３０の短軸方向に列状に延びる電子ビーム通過孔列を構成し、この電子ビーム通過孔列がマスク本体３０の長軸方向に複数列形成された主面部３７と、この主面部３７を取巻く無孔部３８と、この無孔部３８を介して主面部３７のまわりに設けられたスカート部３９とからなる。

【００３３】さらにこの実施例２のマスク本体には、マスク本体の短軸からマスク本体の長径ｗの約１／３の位置を中心として、その長径ｗの約１／４の幅の範囲に位置する長辺側の無孔部３８に、マスク本体の短軸方向に長く、かつ図６（ｂ）に示すように、板厚が無孔部３８の他の部分の板厚、すなわちマスク本体３０の板厚よりも薄いスリット状の凹孔４５が形成されている。さらにマスク本体の長径ｗの約１／３の位置を中心として、その長径ｗの約１／４の幅の範囲に位置する長辺側のスカート部３９に、同（ｃ）に示したように、管軸方向に長いスリット状の開孔４３が形成されている。なお、４０は、長辺側および短辺側のスカート部３９、およびコーナー部のスカート部３９の解放端縁部に形成された切欠きである。

【００３４】このようなマスク本体は、フォトエッチング法により平板状のフラットマスクを形成したのち、このフラットマスクをプレス成形することにより製造されるが、そのフラットマスクを形成するとき、両面からエッチングして、蛍光体スクリーンと対向する主面部となる部分に電子ビーム通過孔を形成するとともに、スカート部３９に開孔４３を形成し、同時に無孔部３８を一方の面からエッチングして凹孔４５を形成することにより得られる。

【００３５】上記のようにマスク本体の長辺側の無孔部３８にマスク本体の短軸方向に長い凹孔４５を形成すると、電子ビームの衝突によりマスク本体が加熱されても、図７にマスク本体の短軸を横軸、温度を縦軸として曲線４７で示したように、マスク本体全体の温度分布を均一化することができる。すなわち、前述したように無孔部に凹孔を形成しない従来のマスク本体では、電子ビーム通過孔の形成されている主面部と無孔部とで、熱容量が異なるため、その境界部で熱伝導差が生じ、曲線２３で示したように無孔部の温度に対して主面部の温度が極端に高くなり、主面部のドーミングを大きくする原因となったが、上記のように無孔部に凹孔を形成すると、主面部と無孔部との境界部で熱伝導差が減少し、従来のマスク本体にくらべて、主面部の温度が下がり、無孔部の温度が高くなり、マスク本体全体の温度分布を均一化する。このマスク本体全体の温度分布の均一化は、上記のようにスカート部に管軸と同方向に長いスリット状の開孔を形成することにより、さらに助長される。しかもこのスカート部の開孔は、実施例１のマスク本体と同様にスカート部の剛性を低くし、それによりマスク本体の熱膨張を吸収して、主面部が蛍光体スクリーン方向に膨出するドーミングを低減する。その結果、上記温度分布を均一化およびスカート部の剛性低下により、従来マスク本体のドーミングのために生じた色純度の劣化をなくすことができる。

【００３６】また無孔部３８の凹孔４５およびスカート部３９の開孔４３をマスク本体の短軸からマスク本体の長径ｗの約１／３の位置を中心としてその長径ｗの約１／４の幅の範囲に、管軸方向に長いスリット状の開孔４３を形成したことにより、従来局部的に高輝度画像を表示した場合、最も発生しやすかった部分の局部的なドーミングを低減でき、図１５に示した楕円領域２１における蛍光体層に対する電子ビームのランディングずれを効果的に低減することができる。このような効果は、最近のカラー受像管のようにパネルの有効部の曲率が小さい平坦化したカラー受像管の場合、マスク本体の曲率を大きくすることが困難なため、特に有効である。

【００３７】さらにこの実施例２のマスク本体は、図６に示したように、電子ビーム通過孔列の間隔を適正化することにより、ランディングエラーなしに主面部の曲率を適当に変えられる。そのため、長軸上での曲率を大きくでき、マスク本体全体のドーミングを抑制できる。す

なわち、図８に示すように、マスク本体３０の長軸方向周辺部における曲線４８で示す短軸方向の曲率を曲線４９で示すように小さく、曲率半径Ｒｙ を大きくすることができ、その短軸方向の曲率を小さくした分、点５０を通る紙面に垂直な長軸上の曲率を大きくでき、マスク本体３０全体のドーミングを抑制できる。しかしこの場合、図９（ｂ）および（ｃ）に蛍光体スクリーンのストライプ状の３色蛍光体層Ｂ，Ｇ，Ｒの配列ピッチをＰＨＰ、その３色蛍光体層Ｂ，Ｇ，Ｒの間隔をｄとして示したように、

ｄ＜（２／３）ＰHP

または

ｄ＞（２／３）ＰHP

となり、蛍光体スクリーン品位の劣化につながる。したがって上記マスク本体の曲率の変更に対しては、電子ビーム通過孔列の間隔を適切に調整して適正化する必要があり、その適正化によって、図９（ａ）に示すように、

ｄ＝（２／３）ＰHP

と、蛍光体スクリーン品位の劣化のないカラー受像管を構成することができる。なお、上記実施例では、マスク本体の長辺側の無孔部のみに凹孔を形成したが、この凹孔を長辺側の無孔部のほかに、短辺側の無孔部およびスカート部にも形成すると、マスク本体のドーミングについては、上記実施例の場合と大差ないが、長時間、高輝度画像を継続して表示した場合、開孔の形成によってマスク本体の熱容量が小さくなった分、マスク本体のドーミンが大きくなり、好ましくない。

【００３８】実施例３．カラー受像管の全体の構成は、実施例１のカラー受像管とほぼ同じであるので、その説明を省略し、その要部構成であるシャドウマスクのマスク本体について説明する。

【００３９】この実施例３のマスク本体は、実施例２のマスク本体の無孔部の凹孔のかわりに、マスク本体の短軸方向に長いスリット状の開孔を形成したものであり、マスク本体の短軸からマスク本体の長径の約１／３の位置を中心としてマスク本体の長径の約１／４の幅の範囲に位置する長辺側の無孔部およびスカート部に、それぞれスリット状の開孔が形成されている。

【００４０】このようなマスク本体は、フォトエッチング法により平板状のフラットマスクを形成するとき、両面からエッチングして、蛍光体スクリーンと対向する主面部となる部分に電子ビーム通過孔を形成すると同時に、無孔部およびスカート部にも開孔５３を形成し、その後、プレス成形することにより得られる。

【００４１】このようにマスク本体を構成すると、実施例２のマスク本体の無孔部の凹孔のかわりに開孔が形成されている分だけ、主面部と無孔部との熱容量差が小さくなり、実施例２よりも大きな効果が得られる。

【００４２】実際にこのマスク本体が組込まれたカラー受像管について、局部的なドーミングによる３色蛍光体層に対する電子ビームのランディングずれを測定した結果、図１５に示した蛍光体スクリーンの長軸上の点Ｐ1でのランディングずれの改善は、約３％であったが、楕円領域の点Ｐ1 を通る短軸方向の周辺の点Ｐ2 でのランディングずれを約１０％の改善することができた。またこのマスク本体でも、実施例２のマスク本体と同様に、図８に示した短軸方向の曲率半径Ｒｙ を修正し、かつ図９に示したように、蛍光体スクリーンのストライプ状の３色蛍光体層の配列ピッチＰHPを適正化することにより、マスク本体の長軸上のドーミングをさらに抑制することができる。

【００４３】なお、この実施例３のマスク本体は、無孔部に開孔が形成されているため、写真印刷法によりパネルの内面に蛍光体スクリーンを形成するとき、その無孔部３８の開孔パターンも焼付けられるため、パネルの有効部内面に３色蛍光体層を形成する前に蛍光体スクリーン形成領域の外周部に光吸収層を形成しておくことが必要である。

【００４４】実施例４．カラー受像管の全体の構成は、実施例１のカラー受像管とほぼ同じであるので、その説明を省略し、その要部構成であるシャドウマスクのマスク本体について説明する。

【００４５】この実施例４のマスク本体は、図１０に示すように、マスク本体の短軸からマスク本体の長径ｗの約１／３の位置を中心としてマスク本体の長径ｗの約１／４の幅の範囲に位置する長辺側の無孔部３８に、マスク本体の短軸と同方向に長くスリット状の開孔５２が形成されているが、長辺側のスカート部３９には、開孔は形成されてない。

【００４６】このようなマスク本体も、フォトエッチング法により平板状のフラットマスクを形成するとき、両面からエッチングして、蛍光体スクリーンと対向する主面部となる部分に電子ビーム通過孔を形成すると同時に、無孔部３８に開孔５３を形成し、その後、プレス成形することにより得られる。

【００４７】このようにマスク本体を構成しても、前記実施例３のマスク本体とほぼ同様の効果が得られる。

【００４８】

【発明の効果】蛍光体スクリーンと対向する主面部に多数の電子ビーム通過孔が形成され、この主面部のまわりに無孔部を介してスカート部が形成された実質的に矩形状のマスク本体と、そのスカート部に取付けられた実質的に矩形状のマスクフレームとからなるシャドウマスクを有するカラー受像管において、マスク本体のスカート部に管軸方向に長いスリット状貫通孔を形成すると、スカート部の剛性を低くすることができる。したがってそれにより、電子ビームの衝突によりマスク本体が加熱され熱膨張しても、その熱膨張をスカート部の変形により吸収して、主面部が蛍光体スクリーン方向に膨出するマスク本体のドーミングを低減することができる。その結

果、蛍光体層に対する電子ビームのランディングずれによる色純度の劣化を防止することができる。

【００４９】また、マスク本体の短軸からこのマスク本体の長径の約１／３の位置を中心としてその長径の約１／４の幅の範囲に位置する長辺側の無孔部に短軸方向に長い貫通孔または底部板厚がマスク本体の板厚よりも薄い凹孔を形成し、より好ましくは、マスク本体の短軸からこのマスク本体の長径の約１／３の位置を中心としてその長径の約１／４の幅の範囲に位置する長辺側の無孔部に短軸方向に長い貫通孔または底部板厚がマスク本体の板厚よりも薄い凹孔を形成し、かつマスク本体の長径の約１／３の位置を中心としてその長径の約１／４の幅の範囲に位置する長辺側のスカート部に管軸方向に長い貫通孔を形成すると、従来電子ビーム通過孔の形成されている主面部と電子ビーム通過孔の形成されていない無孔部とで熱容量が異なるために生じた主面部と無孔部との境界部での温度差を低減し、主面部の温度上昇を抑えることができ、主面部のドーミングを低減することができる。さらに電子ビーム通過孔列の配列間隔、主面部の曲率を適正化することにより、従来局部的なドーミングが大きく現れた楕円領域（図１６参照）のドーミングを抑制することができる。その結果、蛍光体層に対する電子ビームのランディングずれによる色純度の劣化を防止することができる。

【図面の簡単な説明】

【図１】この発明の実施例１のカラー受像管の構成を示す図である。

【図２】図２（ａ）はそのシャドウマスクのマスク本体の構成を示す図、図２（ｂ）はそのマスク本体のスカート部の開孔を示す図である。

【図３】上記マスク本体の製造方法を説明するために示した平板状のフラットマスクの図である。

【図４】図４（ａ）は上記マスク本体の熱膨張に対する作用を説明するための図、図４（ｂ）は比較のために示した従来のマスク本体の熱膨張に対する作用を説明するための図である。

【図５】図５（ａ）および（ｂ）はそれぞれ上記マスク本体の他の製造方法を説明するために示したフラットマスクの図である。

【図６】図６（ａ）はこの発明の実施例２のカラー受像管のマスク本体の構成を示す図、図６（ｂ）はその無孔部の凹孔を示す図、図６（ｃ）はスカート部の開孔を示す図である。

【図７】上記実施例２のマスク本体の温度分布を従来のマスク本体の温度分布と比較して示す図である。

【図８】上記実施例２のマスク本体の主面部の曲面形状を説明するための図である。

【図９】図９（ａ）ないし（ｃ）はそれぞれ上記マスク本体の主面部の曲面形状と蛍光体スクリーンのストライプ状３色蛍光体層の配列状態を説明するための図である。

【図１０】図１０（ａ）はこの発明の実施例４のカラー受像管のマスク本体の構成を示す図、図１０（ｂ）はその無孔部の開孔を示す図である。

【図１１】従来のカラー受像管の構成を示す図である。

【図１２】上記従来のカラー受像管のマスク本体の構成を示す図である。

【図１３】上記従来のカラー受像管のマスク本体の局部的なドーミングによる蛍光体層に対する電子ビームのランディングずれを説明するための図である。

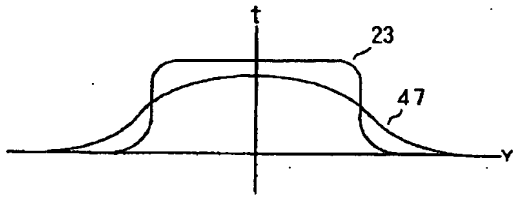
【図１４】上記マスク本体の局部的なドーミングの発生状況を説明するための図である。

【図１５】上記マスク本体の局部的なドーミングによるランディングずれの発生領域を示す図である。

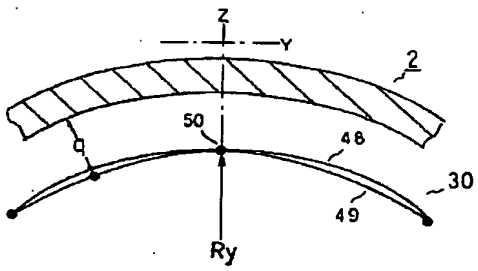
【符号の説明】

４…蛍光体スクリーン
３０…マスク本体
３１…マスクフレーム
３６…電子ビーム通過孔
３７…主面部
３８…無孔部
３９…スカート部
４３…開孔
４５…凹孔
５２…開孔

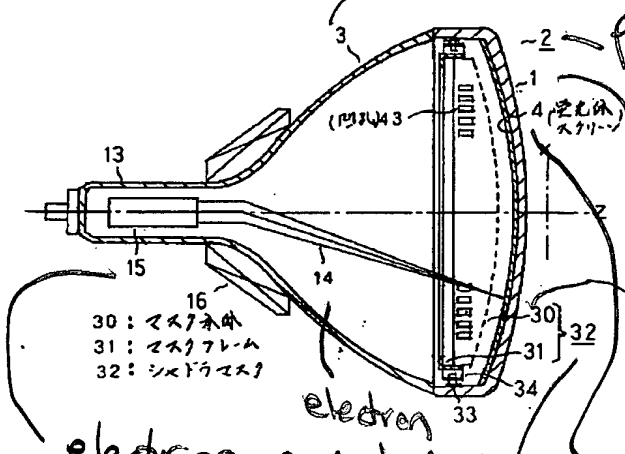
【図７】



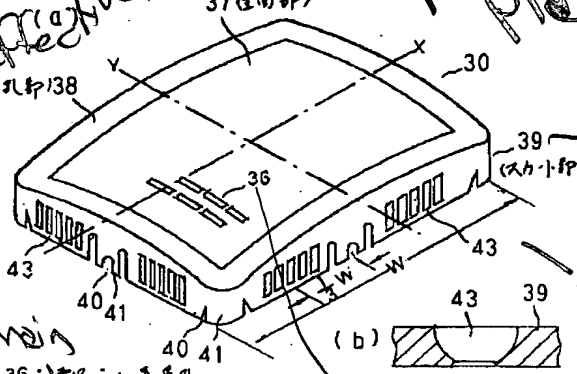
【図８】



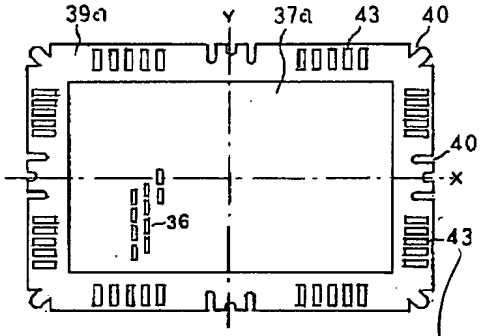
【図１】



【図２】



【図３】



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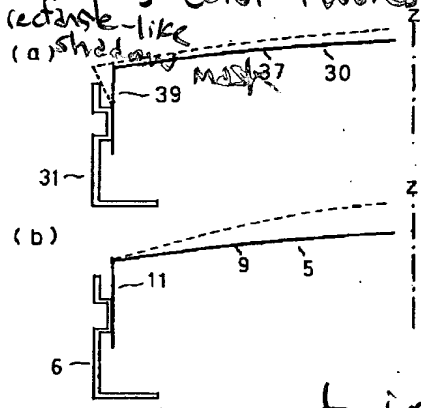
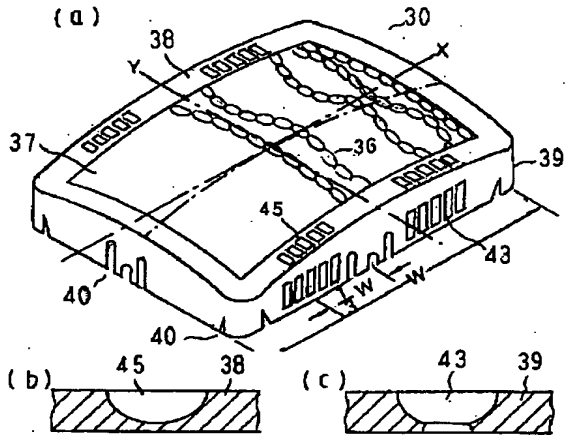
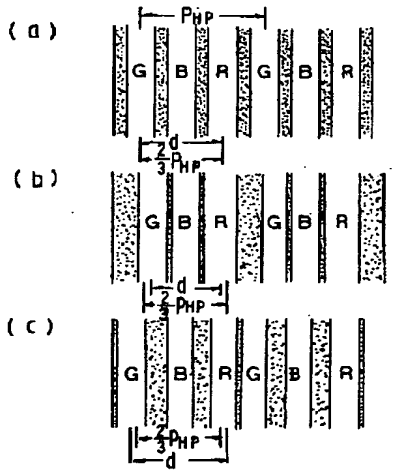


【図６】

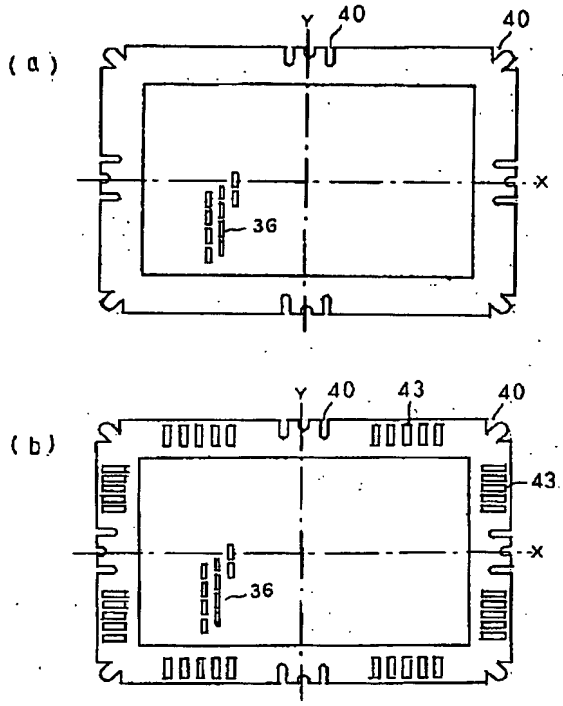


【図９】



funnel
panel
effective section
principal plane section
electron beams
fluorescent substance
hole
skirt board section
slit-like puncturing
3 color fluorescent substance layer
screen
slit-like puncturing
belt-portion
fig 2 no ref. #
No wrinkle
Renee Preston
PCT/US02/04963

【図５】



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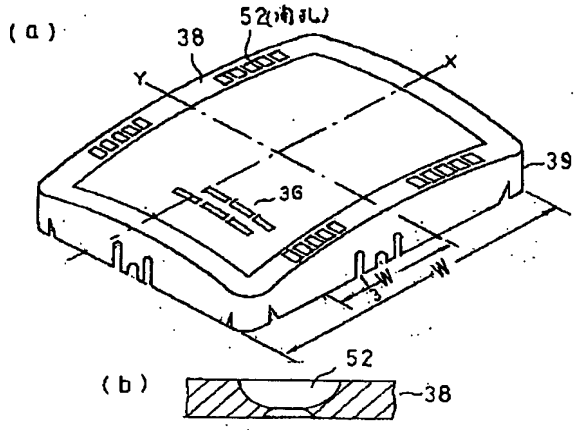
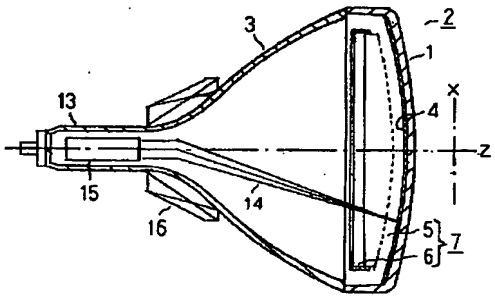
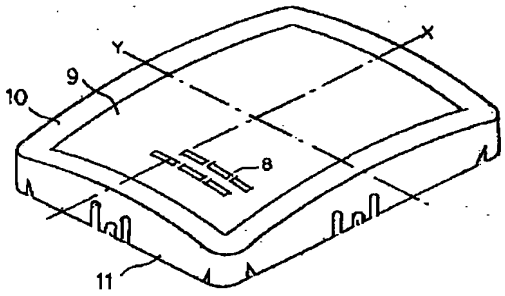


【図１１】



【図１２】



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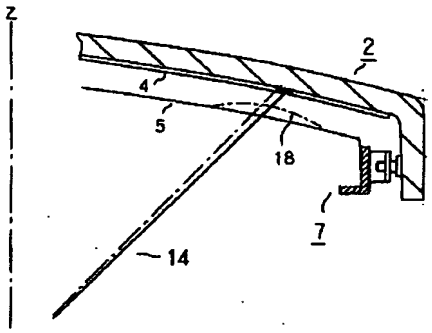
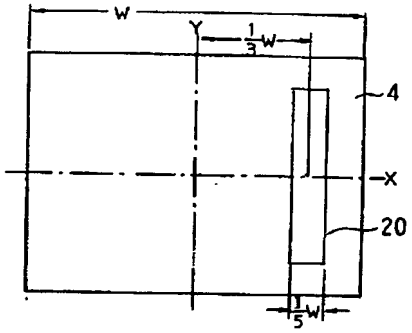
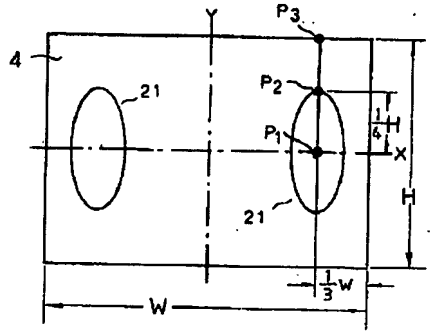


【図１４】



【図１５】



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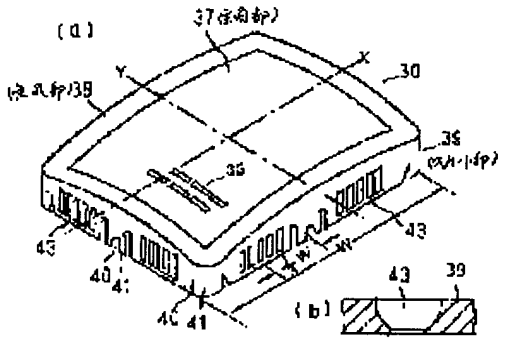
(54) COLOR PICTURE TUBE

(57)Abstract:

PURPOSE: To provide a color picture tube which hardly causes deterioration in color purity by suppressing landing displacement caused by doming of a mas main body.

CONSTITUTION: A color picture tube has a shadow mask comprising a practically square mask main body 3 in which a skirt part 39 is formed around a main face part 37 facing a fluorescent material screen through a no-hole part 38 and a practically square mask frame fixed to the skirt part 39. Slit-like through holes 43 which are long in the tube axis direction are formed in the skirt part 39 of the mask main body 30.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the color picture tube which started the color picture tube, especially suppressed the landing gap of an electron beam to the fluorescent substance layer by the thermal expansion of a shadow mask.

[0002]

[Description of the Prior Art] Generally, the color picture tube has the envelope which consists of a funnel 3 of the shape of a funnel which the effective section 1 becomes from a curved surface substantially joined to rectangle-like a panel 2 and this panel 2, as shown in drawing 11 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000013> . The fluorescent substance screen 4 which becomes the inside of the effective section 1 of the panel 2 from 3 color fluorescent substance layer which emits light in blue, green, and red is formed. The rectangle-like shadow mask 7 is arranged at the real target which furthermore consists of this fluorescent substance screen 4 and a mask frame 6 substantially attached in predetermined interval ****** and its inside at the periphery of the rectangle-like main part 5 of a mask, and this main part 5 of a mask. the main part 5 of a mask is shown in drawing 12 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000014> -- as -- much electron beam passage -- a hole 8 is formed in a predetermined array and consists of the principal plane section 9 which consists of the above-mentioned fluorescent substance screen and a curved surface which counters, the nonporous section 10 which surround this principal plane section 9, and the skirt-board section 11 prepared in the surroundings of the principal plane section 9 through this nonporous section 10 Moreover, the mask frame 6 is formed in a cross-section L typeface, and is attached in the above-mentioned skirt-board section 11 by welding. On the other hand, the electron gun 15 which emits the 3 electron beams 14 is arranged in the neck 13 of a funnel 3. and the magnetic field which the deviation equipment 16 equipped with the 3 electron beams 14 emitted from this electron gun 15 on the outside of a funnel 3 generates -- deviating -- electron beam passage of the above-mentioned main part 5 of a mask -- the fluorescent substance screen 4 is formed in the structure which displays a color picture level and by carrying out a vertical scanning through the hole 8

[0003] In the inline-type color picture tube which emits the 3 electron beams 14 of the single-tier arrangement which passes especially along the same level surface top among such the color

picture tubes 3 color fluorescent substance layer of the fluorescent substance screen 4 is formed in perpendicularly (the direction of a minor axis) it intersects with a tube axis (Z-axis) in the shape of [long and slender] a stripe, and corresponds to this. the main part 5 of a mask two or more perpendicularly long electron beam passage -- electron beam passage **** to which a hole 8 extends perpendicularly was constituted, and this electron beam passage **** had carried out two or more trains parallel arrangement horizontally (the direction of a major axis, X shaft orientations)

[0004] by the way, the above-mentioned shadow mask 7 -- each electron beam passage -- in order to make good color purity of the picture which is for sorting out so that the 3 electron beams 14 which pass a hole 8 at a different angle may land a predetermined fluorescent substance layer, respectively, and is drawn on the fluorescent substance screen 4 by the scan of an electron beam 14 -- each above-mentioned electron beam passage -- it is required to make it the 3 electron beams 14 which pass a hole 8 at a different angle land to a predetermined fluorescent substance layer correctly, respectively For that purpose, it is required to arrange the main part 5 of a mask correctly to the fluorescent substance screen 4 at a predetermined adjustment relation, and to hold working [of the color picture tube] and its adjustment relation. It is especially required to maintain the interval (q value) of effective section 1 inside of a panel 2 and the principal plane section 9 of the main part 5 of a mask at predetermined tolerance.

[0005] however, the above-mentioned color picture tube -- each electron beam passage of a principle-of-operation top and the main part 5 of a mask -- the electron beam which reaches the fluorescent substance screen 4 through a hole 8 is 1/3 or less [of the total amount of electron beams emitted from an electron gun 15], the most collides with the main part 5 of a mask, other electron beams are changed into heat energy, and the main part 5 of a mask is heated at about 80 degrees C In the shadow mask 7 which the result, especially the main part 5 of a mask become from the cold rolled steel plate which is 0.1-0.3mm of board thickness with a large (1.2x10-5/degree C) coefficient of thermal expansion, and the mask frame 6 becomes from the cold rolled steel plate of about 1mm of large board thickness of a mechanical strength rather than it, the so-called doming to which the principal plane section 9 of the main part 5 of a mask bulges on the fluorescent substance screen 4 according to thermal expansion is started. consequently -- if the interval of effective section 1 inside of a panel 2 and the principal plane section 9 of the main part 5 of a mask exceeds an allowed value -- electron beam passage of the main part 5 of a mask -- by position change of a hole 8, the landing of an electron beam 14 to 3 color fluorescent substance layer shifts, and degradation of color purity starts

[0006] The landing gap of 3 electron beams to the above-mentioned 3 color fluorescent substance layer has the landing gap produced in order for the main part of mask 5 whole to expand thermally in early stages of [of operation start] the color picture tube, and the landing gap produced by local doming produced when a high brightness picture is displayed locally. The landing gap changes with the brightness of the picture pattern drawn on a screen, its duration, etc. For example, when a quantity brightness picture is displayed on the whole screen for a long time, degradation of color purity starts in the comparatively large range of the screen whole region. Moreover, when the picture of high brightness is displayed locally, as the dashed line 18 showed to drawing 13 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%

2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000015> , local doming starts, and landing shifts for a short time, and the landing gap is large, and degradation of local color purity starts.

[0007] the above -- about the landing gap by local doming As shown in drawing 14 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000016> , the high brightness pattern 20 of the shape of a rectangle which makes it a major axis perpendicularly by the high current beam is drawn on the fluorescent substance screen 4. As it becomes the largest when the high brightness pattern 20 is drawn on the position which the diameter (major axis) W of screen horizontal separated about 1/3 horizontally from the screen center, as a result of changing the configuration and a position and measuring the amount of gaps of landing, and shown in drawing 15 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000017> The result of becoming the largest in the ellipse field 21 of horizontal pars intermedia is obtained.

[0008] Thus, why a landing gap becomes large by horizontal pars intermedia can be explained as follows. namely, -- although the center section of the principal plane section of the main part of a mask is heated corresponding to this high brightness pattern 20 and it expands thermally, when the high brightness pattern 20 shown in drawing 14 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000016> is drawn on a screen center section -- electron beam passage of the center section of the principal plane section -- since the electron beam which passes a hole has the small deflection angle, a landing gap is small However, a deflection angle becomes large as it moves horizontally from a screen center section, and the degree to which the landing gap by the thermal expansion of the main part of a mask appears on a screen becomes large. However, since the horizontal both ends of the principal plane section of the main part of a mask corresponding to screen horizontal both ends are attached in the large mask frame of a mechanical strength, the thermal expansion of the main part of a mask is suppressed, and the landing gap by screen horizontal both ends becomes small. Consequently, the landing gap by the thermal expansion of the main part of a mask becomes the largest in the ellipse field 21 of horizontal pars intermedia shown in drawing 15 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000017> , when the high brightness pattern 20 is drawn on the pars intermedia which the diameter W of screen horizontal separated from the screen center section about 1/3 horizontally that is,. This ellipse field 21 is the position P1 which the diameter of horizontal of the principal plane section separated from the center section of the principal plane section of the main part of a mask about 1-/3 horizontally. It considers as a center and corresponds to the field

of the diameter of horizontal which makes 4 [about 1-/] width of face.

[0009] Conventionally, some meanses to suppress the landing gap by doming of the above-mentioned main part of a mask are developed. There is a means of the following (b) and a (b) to suppress the landing gap in early stages of a start of operation especially.

(**) Thing O (b) to which prepare the graphite layer which makes a graphite a principal component in the front face of the principal plane section of the main part of a mask that the thermal radiation of the main part of a mask should be promoted, and it was made to reduce the temperature of the main part of a mask by making this graphite layer into a radiator with the means currently described on the U.S. Pat. No. 2,826,538 specifications What prepared glass layers, such as a lead borate glass, in the field by the side of the electron gun of the principal plane section of the main part of a mask O If a lead borate-glass layer is prepared in this way, since the thermal conductivity is smaller than that of the main part of a mask, the heating value transmitted to the main part of a mask decreases, and the temperature rise of the main part of a mask can be suppressed. Moreover, by preparing a lead borate-glass layer, the mechanical strength of the main part of a mask improves. If a lead borate glass furthermore welds and crystallizes on the main part of a mask, tensile stress will act on compressive stress and the main part of a mask at a glass layer, and the flare intensity of the main part of a mask will improve.

[0010] In addition, it is also possible to suppress local doming of the main part of a mask by these meanses.

[0011] As a means to suppress local doming of the main part of a mask furthermore, it is a (c). There is the method of enlarging the curvature of the principal plane section of the main part of a mask. Especially about this method, it is known that it is effective to enlarge the curvature of the direction of a minor axis.

[0012]

[Problem(s) to be Solved by the Invention] As mentioned above, the main part of a mask heats and expands thermally by the collision of the electron beam emitted from an electron gun, doming to which the principal plane section bulges in the direction of a fluorescent substance screen is started, the landing of an electron beam to 3 color fluorescent substance layer shifts, and the shadow mask of the color picture tube has the problem that degradation of color purity starts.

[0013] Conventionally, some meanses to suppress the landing gap by doming of this main part of a mask are developed.

[0014] As shown in a (b) as one of them, there is a method of preparing a graphite layer in the front face of the principal plane section of the main part of a mask. however, vibration to which adhesion of a graphite layer deteriorates and joins the color picture tube with heat treatment by which this method is repeated by the manufacturing process of the color picture tube -- exfoliating -- easy -- the minute piece which exfoliated -- the main part of a mask -- adhering -- electron beam passage -- block a hole -- the grace of the picture displayed on a fluorescent substance screen is reduced Moreover, adhere an electron gun or near the, a spark discharge is

made to induce, and it is easy to produce the problem of reducing a withstand-voltage property.

[0015] Moreover, as shown in a (b), there is a method of preparing glass layers, such as a lead borate glass, in the field by the side of the electron gun of the principal plane section of the main part of a mask. However, since this method has many amounts of the lead oxide (PbO) contained in a lead borate glass as 70 - 85%, the fall of the increase of the scattered reflection within the pipe of the electron beam covered by the shadow mask and the contrast usually called white float produces it. Moreover, when the balance of these stress collapses, it is easy to make the main part of a mask deform by the welding and crystallization, in order that tensile stress may act on compressive stress and the main part of a mask at a glass layer, if board thickness prepares the layer of a lead borate glass in the main part of a mask which consists of a cold rolled steel plate which is 0.1-0.3mm. That is, glass layer thickness is usually 10-20 micrometers. It is 20 micrometers by dispersion on manufacture to the main part of a mask which consists of a cold rolled steel plate of 0.2mm or less of board thickness, for example although it is desirable. When the glass layer of the thickness to exceed is formed, there is a problem that the main part of a mask deforms.

[0016] Moreover, as shown in a (c), there is the method of enlarging the curvature of the principal plane section of the main part of a mask. It is known that it is effective especially to enlarge the curvature of the direction of a minor axis by this method. However, about this method, by the color picture tube with the small curvature of the effective section of the latest panel which carried out flattening, the curvature of the effective circles side is also small, and corresponding to it, it becomes small until the curvature of the principal plane section of the main part of a mask also results on the outskirts from the center of the main part of a mask. Therefore, edge P2 of the perpendicular direction of the ellipse field 21 shown in drawing 15 by the color picture tube which carried out flattening There is an inclination which spreads to the long side side circumference. Moreover, in the color picture tube which carried out flattening, in order to enlarge the curvature of the principal plane section of the main part of a mask, it is necessary to also enlarge the curvature of the effective circles side of a panel. The thick difference of a center section and the periphery of a panel becomes remarkably large, and the aspect ratio of a screen becomes less desirable [on a property] in the oblong color picture tube of 4:3 for the reason. the color picture tube usual [conventional] furthermore -- electron beam passage of the main part of a mask -- the principal plane section in which the hole is formed, and electron beam passage -- in the nonporous section in which a hole is not formed, since heat capacities differ, a heat-conduction difference arises in the boundary section of the principal plane section and the nonporous section Therefore, the temperature distribution of the main part of a mask have problems, like the temperature of the principal plane section becomes extremely high to the temperature of the nonporous section, and doming of the principal plane section tends to become large, as the curve 23 showed to drawing 7 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000009> .

[0017] This invention is made in view of the above-mentioned trouble, and without preparing a graphite layer and a glass layer in the principal plane section of the main part of a mask, the 1st

purpose suppresses the landing gap of an electron beam to the fluorescent substance layer by doming of the main part of a mask, and is to constitute the color picture tube which cannot cause degradation of color purity easily. The 2nd purpose is to suppress the landing gap of an electron beam to the fluorescent substance layer by doming of the main part of a mask, and constitute the color picture tube which cannot cause degradation of color purity easily, without enlarging the curvature of the principal plane section of the main part of a mask.

[0018]

[Means for Solving the Problem] a fluorescent substance screen and the principal plane section which counters -- much electron beam passage -- in the color picture tube which has the shadow mask by which the hole was formed and the skirt-board section was formed in the surroundings of this principal plane section through the nonporous section, which was attached in rectangle-like the main part of a mask and the skirt-board section, and which consists of a rectangle-like mask frame substantially, the long slit-like breakthrough was substantially formed in the direction of a tube axis at the skirt-board section of the main part of a mask

[0019] moreover, a fluorescent substance screen and the principal plane section which counters -- much electron beam passage -- the hole was formed and the skirt-board section was formed in the surroundings of this principal plane section through the nonporous section -- with rectangle-like the main part of a mask substantially It has the shadow mask which was attached in the skirt-board section and which consists of a rectangle-like mask frame substantially. In the color picture tube which constitutes electron beam passage **** to which a hole extends in the direction of a minor axis of the main part of a mask at a seriate and which comes to carry out two or more trains array of this electron beam passage **** in the direction of a major axis of the main part of a mask electron beam passage -- about [of the major axis of the minor axis of the main part of a mask to this main part of a mask] -- a center [positions / one third of] -- carrying out -- about / of the major axis / -- a long breakthrough or bottom board thickness formed the concave hole thinner than the board thickness of the main part of a mask in the direction of a minor axis at the nonporous section by the side of the long side located in the range of one fourth of width of face

[0020] A long breakthrough or a concave hole with bottom board thickness thinner than the board thickness of the main part of a mask is formed in the direction of a minor axis at the nonporous section by the side of the long side located in the range of one fourth of width of face. further -- about [of the major axis of the minor axis of the main part of a mask to this main part of a mask] -- a center [positions / one third of] -- carrying out -- about / of the major axis / -- about [and / of the major axis of the main part of a mask] -- a center [positions / one third of] -- carrying out -- about / of the major axis / -- the long breakthrough was formed in the direction of a tube axis at the skirt-board section by the side of the long side located in the range of one fourth of width of face

[0021]

[Function] As mentioned above, if a long slit-like breakthrough is formed in the direction of a tube axis at the skirt-board section of the main part of a mask, rigidity of the skirt-board section can be made low. Therefore, even if the main part of a mask is heated by the collision of an

electron beam and it expands thermally by that cause, the thermal expansion can be absorbed by deformation of the skirt-board section, and doming of the main part of a mask with which the principal plane section bulges in the direction of a fluorescent substance screen can be reduced. Consequently, degradation of the color purity by the landing gap of an electron beam to a fluorescent substance layer can be prevented.

[0022] A long breakthrough or a concave hole with bottom board thickness thinner than the board thickness of the main part of a mask is formed in the direction of a minor axis at the nonporous section by the side of the long side located in the range of one fourth of width of face. about [moreover, / of the major axis of the minor axis of the main part of a mask to this main part of a mask] -- a center [positions / one third of] -- carrying out -- about / of the major axis / -- more preferably A long breakthrough or a concave hole with bottom board thickness thinner than the board thickness of the main part of a mask is formed in the direction of a minor axis at the nonporous section by the side of the long side located in the range of one fourth of width of face. about [of the major axis of the minor axis of the main part of a mask to this main part of a mask] -- a center [positions / one third of] -- carrying out -- about / of the major axis / -- about [and / of the major axis of the main part of a mask] -- a center [positions / one third of] -- carrying out -- about / of the major axis /, if a long breakthrough is formed in the direction of a tube axis at the skirt-board section by the side of the long side located in the range of one fourth of width of face the conventional electron beam passage -- the principal plane section in which the hole is formed, and electron beam passage -- the temperature gradient in the boundary section of the principal plane section and the nonporous section which were produced since heat capacities differed in the nonporous section in which a hole is not formed is reduced, the temperature rise of the principal plane section can be stopped and doming of the principal plane section can be reduced Conventionally local doming can suppress doming of an ellipse field (refer to drawing 16) which appeared greatly by furthermore rationalizing the array interval of electron beam passage ****, and the curvature of the principal plane section. Consequently, degradation of the color purity by the landing gap of an electron beam to a fluorescent substance layer can be prevented.

[0023]

[Example] Hereafter, with reference to a drawing, this invention is explained based on an example.

[0024] The color picture tube of an example 1 is shown in example 1. drawing 1 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000003> . This color picture tube has the envelope which consists of a funnel 3 of the shape of a funnel which the effective section 1 becomes from a curved surface substantially joined to rectangle-like a panel 2 and this panel 2. The fluorescent substance screen 4 which becomes the inside of the effective section 1 of the panel 2 from 3 color fluorescent substance layer which emits light in blue, green, and red is formed. It is supported inside the panel 2 with two or more elastic-support objects 34 which are attached in two or more stud pins 33 which

consist of a mask frame 31 furthermore attached in the periphery of this fluorescent substance screen 4, the main part 30 of a mask later mentioned to predetermined interval ****** and its inside, and this main part 30 of a mask, and which the rectangle-like shadow mask 32 has been arranged substantially and prepared in the panel 2, and the mask frame 31, and stop at each of that stud pin 33. On the other hand, the electron gun 15 which emits the 3 electron beams 14 is arranged in the neck 13 of a funnel 3. and the magnetic field which the deviation equipment 16 equipped with the 3 electron beams 14 emitted from this electron gun 15 on the outside of a funnel 3 generates -- deviating -- electron beam passage of the above-mentioned main part 5 of a mask -- the fluorescent substance screen 4 is formed in the structure which displays a color picture level and by carrying out a vertical scanning through the hole 8

[0025] The main part 30 of a mask of the above-mentioned shadow mask 32 As it is formed in the real target which consists of a cold rolled steel plate of 0.1-0.3mm of board thickness in the shape of a rectangle and is shown in drawing 2 (a) Electron beam passage **** to which a hole 36 extends in the direction of a minor axis at a seriate is constituted. two or more slit-like electron beam passage long in the direction of a minor axis of the main part 30 of a mask (Y shaft orientations) to the above-mentioned fluorescent substance screen and the curved surface which counters -- It consists of the skirt-board section 39 by which this electron beam passage **** was prepared in the direction of a major axis of the main part 30 of a mask (X shaft orientations) around the principal plane section 37 through the principal plane section 37 by which two or more trains formation was carried out, the nonporous section 38 which surrounds this principal plane section 37, and this nonporous section 38. Two or more notches 40 are formed in the release edge section of the long side side, a center section, and the corner section skirt-board section 39 of the shorter side side skirt-board section 39, respectively. On the other hand, the mask frame 31 is formed in the shape of a rectangle substantially [the cross-section L typeface which consists of a cold rolled steel plate of about 1mm of board thickness]. And the main part 30 of these masks and the mask frame 31 **** the skirt-board section 39 of the main part 30 of a mask inside the mask frame 31, and are welded in the tongue-shaped piece section 41 surrounded by the above-mentioned notch 40.

[0026] Parallel formation of two or more slit-like puncturing 43 furthermore shown in the main part 30 of a mask of this example 1 at drawing 2 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000004> (b) respectively long to the cross direction (the direction of a tube axis and coincidence) of the skirt-board section 39 at the pars intermedia of a long side side and a center section, and the corner section of the shorter side side skirt-board section 39 is carried out. the inside of these puncturing 43 -- especially -- the puncturing 43 by the side of a long side -- desirable -- about [of the major axis w of the minor axis of the main part 30 of a mask to the main part 30 of a mask] -- a center [positions / one third of] -- carrying out -- about / of the major axis w / -- it is prepared in the range of one fourth of width of face

[0027] Although it is manufactured by carrying out press forming of this flat mask like the conventional main part of a mask after such a main part 30 of a mask forms a plate-like flat mask

by the photo etching method When forming the flat mask, as it **********s from both sides and is shown in drawing 3 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000005> partial 37a used as a fluorescent substance screen and the principal plane section which counters electron beam passage -- partial 39a which becomes the skirt-board section at the same time it forms a hole 36 in a predetermined array It is obtained by forming a notch 40 and puncturing 43.

[0028] By the way, as mentioned above, if the slit-like puncturing 43 is formed in the skirt-board section 39 of the main part 30 of a mask, compared with the main part of a mask which does not prepare slit-like puncturing in the conventional skirt-board section, rigidity of the skirt-board section 39 can be made low. Consequently, as shown in drawing 4 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000006> (a), when the main part 30 of a mask is heated by the collision of an electron beam and it expands thermally, it absorbs by deformation of the skirt-board section 39 which showed the thermal expansion with the dashed line, and reducing doming to which the principal plane section 37 bulges in the direction of a fluorescent substance screen comes out.

[0029] namely, about the conventional shadow mask Since the periphery of the main part 5 of a mask is comparatively attached in the mask frame 6 through the rigid high skirt-board section 11 as shown in drawing 4 (b) Although doming which bulges greatly started in the direction of a fluorescent substance screen as the principal plane section 9 showed with the dashed line, the landing of an electron beam to a fluorescent substance layer shifted and degradation of color purity arose according to thermal expansion when the main part 5 of a mask was heated by the collision of an electron beam If the slit-like puncturing 43 is formed in the skirt-board section 39 like the main part 30 of a mask of this example, by the rigid fall, as shown in drawing 4 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000006> (a), the skirt-board section 39 can deform, and doming to which the principal plane section 37 bulges in the fluorescent substance screen 4 direction can be reduced. Therefore, the landing gap of an electron beam to a fluorescent substance layer becomes small, and can prevent degradation of color purity. And even if it forms the slit-like puncturing 43 in the skirt-board section 39 of the main part 30 of a mask as mentioned above, the release edge of the skirt-board section 39 is connected like the skirt-board section of the conventional main part of a mask, cannot make difficult insertion of the skirt-board section inside a mask frame, and can assemble it like the assembly of the conventional shadow mask.

[0030] in addition, the time of forming a flat mask for slit-like puncturing of the skirt-board section of the main part of a mask in the above-mentioned example -- the photo etching method -- electron beam passage of the principal plane section -- a hole -- simultaneously, although formed As shown in drawing 5 (a), when forming a flat mask by the photo etching method,

electron beam passage of the principal plane section -- a hole 36, simultaneously slit-like puncturing of the skirt-board section may not be formed, but after flat mask formation, by stamping, as shown in ** (b), you may form the slit-like puncturing 43 in the portion used as the skirt-board section of the above-mentioned flat mask

[0031] Since the composition of the whole example 2. color picture tube is almost the same as the color picture tube of an example 1, the explanation is omitted and the main part of a mask which is the important section composition is explained.

[0032] As the main part of a mask of this example 2 is formed in the real target which consists of a cold rolled steel plate of 0.1-0.3mm of board thickness in the shape of a rectangle and is shown in drawing 6 (a) Electron beam passage **** to which a hole 36 extends in the direction of a minor axis of the main part 30 of a mask at a seriate is constituted. slit-like electron beam passage of plurality [curved surface / which counters / a fluorescent substance screen and] -- It consists of the skirt-board section 39 by which this electron beam passage **** was prepared in the direction of a major axis of the main part 30 of a mask around the principal plane section 37 through the principal plane section 37 by which two or more trains formation was carried out, the nonporous section 38 which surrounds this principal plane section 37, and this nonporous section 38.

[0033] Furthermore, it centers on the position of the abbreviation 1/3 of the major axis w of the main part of a mask on the main part of a mask of this example 2 from the minor axis of the main part of a mask. about [of the major axis w] -- it is long in the direction of a minor axis of the main part of a mask, and as shown in drawing 6 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000008> (b), the concave hole 45 of the shape of a slit with board thickness thinner than the board thickness of other portions of the nonporous section 38, i.e., the board thickness of the main part 30 of a mask, is formed in the nonporous section 38 by the side of the long side located in the range of one fourth of width of face further -- about [of the major axis w of the main part of a mask] -- a center [positions / one third of] -- carrying out -- about / of the major axis w / -- as shown in the skirt-board section 39 by the side of the long side located in the range of one fourth of width of face at ** (c), the puncturing 43 of the shape of a long slit is formed in the direction of a tube axis In addition, 40 is the notch formed in the release edge section of the skirt-board section 39 by the side of a long side and a shorter side, and the skirt-board section 39 of the corner section.

[0034] Although it is manufactured by carrying out press forming of this flat mask after such a main part of a mask forms a plate-like flat mask by the photo etching method the portion which **********s from both sides and serves as a fluorescent substance screen and the principal plane section which counters when forming the flat mask -- electron beam passage, while forming a hole It is obtained by forming puncturing 43 in the skirt-board section 39, **********ing the nonporous section 38 from one field simultaneously, and forming a concave hole 45.

[0035] If the long concave hole 45 is formed in the direction of a minor axis of the main part of a

mask as mentioned above at the nonporous section 38 by the side of the long side of the main part of a mask, even if the main part of a mask will be heated by the collision of an electron beam, as setting a horizontal axis as the minor axis of the main part of a mask and the curve 47 showed by setting a vertical axis as temperature at drawing 7 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000009> , the temperature distribution of the whole main part of a mask can be equalized. namely, by the conventional main part of a mask which does not form a concave hole in the nonporous section as mentioned above electron beam passage, although the temperature of the principal plane section became extremely high to the temperature of the nonporous section as a heat-conduction difference arises in the boundary section and the curve 23 showed, and it became the cause which enlarges doming of the principal plane section in the principal plane section and the nonporous section in which the hole is formed, since heat capacities differed If a concave hole is formed in the nonporous section as mentioned above, a heat-conduction difference decreases in the boundary section of the principal plane section and the nonporous section, the temperature of the principal plane section will fall compared with the conventional main part of a mask, the temperature of the nonporous section will become high, and the temperature distribution of the whole main part of a mask will be equalized. Equalization of the temperature distribution of this whole main part of a mask is further promoted by forming puncturing of the shape of a long slit in a tube axis and this direction as mentioned above at the skirt-board section. And puncturing of this skirt-board section makes rigidity of the skirt-board section low like the main part of a mask of an example 1, absorbs the thermal expansion of the main part of a mask by that cause, and reduces doming to which the principal plane section bulges in the direction of a fluorescent substance screen. Consequently, degradation of the color purity which produced the above-mentioned temperature distribution conventionally by the reduction of rigidity of equalization and the skirt-board section for doming of the main part of a mask can be lost.

[0036] moreover, the concave hole 45 of the nonporous section 38 and the puncturing 43 of the skirt-board section 39 -- about [of the major axis w of the minor axis of the main part of a mask to the main part of a mask] -- a center [positions / one third of] -- carrying out -- about / of the major axis w / -- in the range of one fourth of width of face When a high brightness picture is conventionally displayed locally by having formed the puncturing 43 of the shape of a long slit in the direction of a tube axis, Local doming of the portion which was the easiest to generate can be reduced, and the landing gap of an electron beam to the fluorescent substance layer in the ellipse field 21 shown in drawing 15 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000017> can be reduced effectively. enlarging the curvature of the main part of a mask, when such an effect is the color picture tube with the small curvature of the effective section of a panel which carried out flattening like the latest color picture tube -- eye a difficult hatchet -- especially, it is effective

[0037] Furthermore, the main part of a mask of this example 2 can change the curvature of the principal plane section without a landing error suitably by rationalizing the interval of electron

beam passage ****, as shown in drawing 6 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000008> . Therefore, the curvature on a major axis can be enlarged and doming of the whole main part of a mask can be suppressed. That is, in the curvature of the direction of a minor axis shown with the curve 48 in the direction periphery of a major axis of the main part 30 of a mask as shown in drawing 8 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000010> , as a curve 49 shows, it is small, and it is radius of curvature Ry. The curvature on a major axis perpendicular to the part which could enlarge and made small the curvature of the direction of a minor axis, and the space which passes along a point 50 can be enlarged, and doming of the main part of mask 30 whole can be suppressed However, in this case, it is set to drawing 9 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000011> (b) and (c) with d<(2/3)PHP or d> (2/3) PHP, and the array pitch of 3 color fluorescent substance layers B, G, and R of the shape of a stripe of a fluorescent substance screen is led to degradation of fluorescent substance screen grace at them, as the interval of PHP and its 3 color fluorescent substance layers B, G, and R was shown as d. Therefore, to change of the curvature of the above-mentioned main part of a mask, it is necessary to adjust the interval of electron beam passage **** appropriately, and to rationalize it, and the rationalization can constitute the color picture tube without d=(2/3) PHP and degradation of fluorescent substance screen grace, as shown in drawing 9 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000011> (a). In addition, although the concave hole was formed only in the nonporous section by the side of the long side of the main part of a mask in the above-mentioned example When this concave hole is formed also in the nonporous section and the skirt-board section by the side of a shorter side besides the nonporous section by the side of a long side, about doming of the main part of a mask Although it was practically equal, when a high brightness picture is continued and displayed as the case of the above-mentioned example for a long time, the dormin of the part to which the heat capacity of the main part of a mask became small by formation of puncturing, and the main part of a mask becomes large, and is not desirable.

[0038] Since the composition of the whole example 3. color picture tube is almost the same as the color picture tube of an example 1, the explanation is omitted and the main part of a mask of the shadow mask which is the important section composition is explained.

[0039] The main part of a mask of this example 3 instead of the concave hole of the nonporous section of the main part of a mask of an example 2 Puncturing of the shape of a long slit is formed in the direction of a minor axis of the main part of a mask. about [of the major axis of the minor axis of the main part of a mask to the main part of a mask] -- a center [positions / one

third of] -- carrying out -- about / of the major axis of the main part of a mask / -- slit-like puncturing is formed in the nonporous section and the skirt-board section by the side of the long side located in the range of one fourth of width of face, respectively

[0040] the portion which such a main part of a mask **********s from both sides when forming a plate-like flat mask by the photo etching method, and serves as a fluorescent substance screen and the principal plane section which counters -- electron beam passage -- puncturing 53 is formed also at the nonporous section and the skirt-board section, and it is obtained by carrying out press forming after that at the same time it forms a hole

[0041] Thus, if the main part of a mask is constituted, the heat-capacity difference of the principal plane section and the nonporous section will become small, and a bigger effect than an example 2 will be acquired only for the part in which puncturing is formed instead of the concave hole of the nonporous section of the main part of a mask of an example 2.

[0042] point P1 on the major axis of the fluorescent substance screen shown in drawing 15 as a result of measuring the landing gap of an electron beam to 3 color fluorescent substance layer by local doming about the color picture tube into which this main part of a mask was actually built although the improvement of a landing gap was about 3% -- point P1 of an ellipse field Surrounding point P2 of the direction of a minor axis along which it passes a landing gap -- about 10% -- it is improvable Moreover, radius of curvature Ry of the direction of a minor axis shown in drawing 8 by this main part of a mask as well as the main part of a mask of an example 2 As it corrects and was shown in drawing 9 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000011> , doming on the major axis of the main part of a mask can be further suppressed by rationalizing array-pitch PHP of 3 color fluorescent substance layer of the shape of a stripe of a fluorescent substance screen.

[0043] In addition, the main part of a mask of this example 3 needs to form an optical-absorption layer in the periphery section of a fluorescent substance screen formation field, before forming 3 color fluorescent substance layer in the effective circles side of a panel since the puncturing pattern of the nonporous section 38 is also baked, when forming a fluorescent substance screen in the inside of a panel by the photoprint method, since puncturing is formed in the nonporous section.

[0044] Since the composition of the whole example 4. color picture tube is almost the same as the color picture tube of an example 1, the explanation is omitted and the main part of a mask of the shadow mask which is the important section composition is explained.

[0045] the main part of a mask of this example 4 is shown in drawing 10 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000012> -- as -- about [of the major axis w of the minor axis of the main part of a mask to the main part of a mask] -- a center [positions / one third of] -- carrying out -- about --

puncturing is not formed in the skirt-board section 39 by the side of a long side although the slit-like puncturing 52 is formed in the minor axis and this direction of the main part of a mask for a long time at the nonporous section 38 by the side of the long side located in the range of one

[0046] the portion which **********s from both sides and serves as a fluorescent substance screen and the principal plane section which counters when such a main part of a mask also forms a plate-like flat mask by the photo etching method -- electron beam passage -- puncturing 53 is formed at the nonporous section 38, and it is obtained by carrying out press forming after that at the same time it forms a hole

[0047] Thus, even if it constitutes the main part of a mask, the almost same effect as the main part of a mask of the aforementioned example 3 is acquired.

[0048]

[Effect of the Invention] a fluorescent substance screen and the principal plane section which counters -- much electron beam passage -- the hole was formed and the skirt-board section was formed in the surroundings of this principal plane section through the nonporous section -- with rectangle-like the main part of a mask substantially In the color picture tube which has the shadow mask which was attached in the skirt-board section, and which consists of a rectangle-like mask frame substantially, if a long slit-like breakthrough is formed in the direction of a tube axis at the skirt-board section of the main part of a mask, rigidity of the skirt-board section can be made low. Therefore, even if the main part of a mask is heated by the collision of an electron beam and it expands thermally by that cause, the thermal expansion can be absorbed by deformation of the skirt-board section, and doming of the main part of a mask with which the principal plane section bulges in the direction of a fluorescent substance screen can be reduced. Consequently, degradation of the color purity by the landing gap of an electron beam to a fluorescent substance layer can be prevented.

[0049] A long breakthrough or a concave hole with pars-basilaris-ossis-occipitalis board thickness thinner than the board thickness of the main part of a mask is formed in the direction of a minor axis at the nonporous section by the side of the long side located in the range of one fourth of width of face. about [moreover, / of the major axis of the minor axis of the main part of a mask to this main part of a mask] -- a center [positions / one third of] -- carrying out -- about / of the major axis / -- more preferably A long breakthrough or a concave hole with pars-basilaris-ossis-occipitalis board thickness thinner than the board thickness of the main part of a mask is formed in the direction of a minor axis at the nonporous section by the side of the long side located in the range of one fourth of width of face. about [of the major axis of the minor axis of the main part of a mask to this main part of a mask] -- a center [positions / one third of] -- carrying out -- about / of the major axis / -- about [and / of the major axis of the main part of a mask] -- a center [positions / one third of] -- carrying out -- about / of the major axis /, if a long breakthrough is formed in the direction of a tube axis at the skirt-board section by the side of the long side located in the range of one fourth of width of face the conventional electron beam passage -- the principal plane section in which the hole is formed, and electron beam passage -- the temperature gradient in the boundary section of the principal plane section and the nonporous section which were produced since heat capacities differed in the nonporous section in which a

hole is not formed is reduced, the temperature rise of the principal plane section can be stopped and doming of the principal plane section can be reduced Conventionally local doming can suppress doming of an ellipse field (refer to drawing 16) which appeared greatly by furthermore rationalizing the array interval of electron beam passage ****, and the curvature of the principal plane section. Consequently, degradation of the color purity by the landing gap of an electron beam to a fluorescent substance layer can be prevented.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000003> It is drawing showing the composition of the color picture tube of the example 1 of this invention.

[Drawing 2] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000004> Drawing in which drawing 2 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000004> (a) shows the composition of the main part of a mask of the shadow mask, and drawing 2 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000004> (b) are drawings showing puncturing of the skirt-board section of the main part of a mask.

[Drawing 3] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000005> It is drawing of the plate-like flat mask shown in order to explain the manufacture method of the above-mentioned main part of a mask.

[Drawing 4] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%

5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000006> Drawing for drawing 4 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000006> (a) explaining the operation to the thermal expansion of the above-mentioned main part of a mask and drawing 4 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000006> (b) are drawings for explaining the operation to the thermal expansion of the conventional main part of a mask shown for comparison.

[Drawing 5] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000007> Drawing 5 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000007> (a) and (b) are drawings of the flat mask shown in order to explain other manufacture methods of the above-mentioned main part of a mask, respectively.

[Drawing 6] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000008> Drawing in which drawing 6 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000008> (a) shows the composition of the main part of a mask of the color picture tube of the example 2 of this invention, drawing in which drawing 6 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000008> (b) shows the concave hole of the nonporous section, and drawing 6 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000008> (c) are drawings showing puncturing of the skirt-board section.

[Drawing 7] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000009> It is drawing showing the temperature distribution of the main part of a mask of the above-mentioned example 2 as compared with the temperature distribution of the conventional main part of a mask.

[Drawing 8] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000010> It is drawing for explaining the curved-surface configuration of the principal plane section of the main part of a mask of the above-mentioned example 2.

[Drawing 9] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000011> Drawing 9 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000011> (a) or (c) is drawing for explaining the curved-surface configuration of the principal plane section of the above-mentioned main part of a mask, and the array state of the stripe-like 3 color fluorescent substance layer of a fluorescent substance screen, respectively.

[Drawing 10] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000012> Drawing in which drawing 10 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000012> (a) shows the composition of the main part of a mask of the color picture tube of the example 4 of this invention, and drawing 10 <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000012> (b) are drawings showing puncturing of the nonporous section.

[Drawing 11] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000013> It is drawing showing the composition of the conventional color picture tube.

[Drawing 12] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000014> It is drawing showing the composition of the main part of a mask of the above-mentioned conventional color picture tube.

[Drawing 13] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%

26N0553%3D000015> It is drawing for explaining the landing gap of an electron beam to the fluorescent substance layer by local doming of the main part of a mask of the above-mentioned conventional color picture tube.

[Drawing 14] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000016> It is drawing for explaining the generating situation of local doming of the above-mentioned main part of a mask.

[Drawing 15] <http://www4.ipdl.jpo.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww6.ipdl.jpo.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D67%3F87%2F%2F%2F%26N0001%3D47%26N0552%3D9%26N0553%3D000017> It is drawing showing the generating field of the landing gap by local doming of the above-mentioned main part of a mask.

[Description of Notations]

4 -- Fluorescent substance screen

30 -- Main part of a mask

31 -- Mask frame

36 -- electron beam passage -- a hole

37 -- Principal plane section

38 -- Nonporous section

39 -- Skirt-board section

43 -- Puncturing

45 -- Concave hole

52 -- Puncturing

[Translation done.]

CLAIMS

[Claim(s)]

[Claim 1] a fluorescent substance screen and the principal plane section which counters -- much electron beam passage -- the hole was formed and the skirt-board section was formed in the surroundings of this principal plane section through the nonporous section -- substantial -- rectangle-like the main part of a mask The shadow mask which was attached in the above-mentioned skirt-board section and which consists of a rectangle-like mask frame substantially. It is the color picture tube equipped with the above, and the above-mentioned main part of a mask is characterized by forming the long slit-like breakthrough in the direction of a tube axis at the above-mentioned skirt-board section.

[Claim 2] a fluorescent substance screen and the principal plane section which counters -- much electron beam passage -- the hole was formed and the skirt-board section was formed in the surroundings of this principal plane section through the nonporous section -- substantial -- rectangle-like the main part of a mask It is a rectangle-like mask frame to the real target attached in the above-mentioned skirt-board section. the color picture tube equipped with the above -- it is -- the above-mentioned main part of a mask -- about [of the major axis of the minor axis of this main part of a mask to this main part of a mask] -- a center [positions / one third of] -- carrying out -- about / of the above-mentioned major axis / -- it is characterized by forming the long breakthrough or the concave hole with bottom board thickness thinner than the board thickness of the main part of a mask in the above-mentioned minor-axis direction at the nonporous section by the side of the long side located in the range

[Claim 3] a fluorescent substance screen and the principal plane section which counters -- much electron beam passage -- the hole was formed and the skirt-board section was formed in the surroundings of this principal plane section through the nonporous section -- substantial -- rectangle-like the main part of a mask It is a rectangle-like mask frame to the real target attached in the above-mentioned skirt-board section. It is the color picture tube equipped with the above. A long breakthrough or a concave hole with bottom board thickness thinner than the board thickness of the main part of a mask is formed in the above-mentioned minor-axis direction at the nonporous section by the side of the long side located in the range of one fourth of width of face. the above-mentioned main part of a mask -- about [of the major axis of the minor axis of this main part of a mask to this main part of a mask] -- a center [positions / one third of] -- carrying out -- about / of the above-mentioned major axis / -- about [and / of the major axis of the above-mentioned main part of a mask] -- a center [positions / one third of] -- carrying out -- about / of the above-mentioned major axis / -- it is characterized by forming the long breakthrough in the direction of a tube axis at the skirt-board section by the side of the long side located in the range of one fourth of width of face

[Translation done.]